What is claimed is:

1. A communications network comprising:

a plurality of transmission links; and

a plurality of nodes for interconnecting said links to form a working ring and a protection ring in a ring topology, and establishing a plurality of working paths on said working ring and a plurality of protection paths on said protection ring corresponding to said plurality of working paths,

one of said working paths spanning across first and second nodes of said plurality of nodes for transmission of a signal in a first direction of said ring topology,

one of said protection paths spanning across said first and second nodes for transmission of a signal in a second direction of said ring topology opposite to said first direction,

said first and second nodes normally using said one working path and being responsive to a failure of said one working path for using said one protection path instead of said one working path.

2. A communications network comprising:

a plurality of transmission links; and

a plurality of nodes for interconnecting said transmission links to form first and second working rings and first and second protection rings in a ring topology, and establishing a plurality of working paths on each of said working rings and a plurality of protection paths on each of said protection rings corresponding to said plurality of working paths,

a first one of said working paths of said first working ring spanning across first and second nodes of said plurality of nodes for transmission of a signal in a first direction of said ring topology,

a second one of said working paths of said second working ring spanning across the first and second nodes for transmission of a signal in a second direction of the ring topology opposite to the first direction,

a first one of said protection paths on said first protection ring

spanning across the first and second nodes for transmission of a signal in said second direction of said ring topology,

a second one of said protection paths of said second protection ring spanning across the first and second nodes for transmission of a signal in said first direction of said ring topology,

said first and second nodes normally using said first and second working paths, respectively, and being responsive to a failure of one of said first and second working paths for using a corresponding one of the first and second protection paths instead of the failed working path.

3. A communications network comprising:

a plurality of transmission links; and

a plurality of nodes for interconnecting said links to form a working ring and a protection ring in a ring topology, and establishing a plurality of working paths on said working ring and a plurality of extra traffic paths on said protection ring,

one of said working paths spanning across first and second nodes of said plurality of nodes for transmission of a signal in a first direction of said ring topology,

one of said extra traffic paths spanning across said first and second nodes for transmission of a low-priority signal in a second direction of said ring topology opposite to said first direction,

said first and second nodes normally using said one working path and being responsive to a failure of said one working path for clearing said one extra traffic path to establish a first protection path and using the first protection path, clearing other extra traffic paths to establish a second protection path if said first protection path is not successfully established and using said second protection path instead of the failed working path, said first protection path having a shorter length than said second protection path.

4. A communications network as claimed in claim 2, wherein first

and second working paths of said plurality of working paths are assigned a first network resource and first and second protection paths of said plurality of protection paths are assigned a second network resource,

said first node normally using said first network resource and said first working path and being responsive to a failure in said first ring for using said second network resource and said second protection path instead of said first network resource and said first working path,

said second node normally using said second network resource and said second working path and being responsive to a failure of the second ring for using said first network resource and said first protection path instead of the second network resource and the second working path.

5. A communications network as claimed in claim 2, wherein first and second working paths of said plurality of working paths are assigned first and second network resources, respectively, and first and second protection paths of said plurality of protection paths are assigned said second and first network resources, respectively,

said first node normally using said first network resource and said first working path and being responsive to a failure of said first ring for using said second protection path instead of said first working path,

said second node normally using said second network resource and said second working path and being responsive to a failure of the second ring for using the first protection path instead of the second protection path.

6. A communications network as claimed in claim 4 or 5, wherein said first and second network resources are optical energy of different wavelengths.

7. A communications network as claimed in claim 1, 2, 3, 4 or 5, wherein said first node is arranged to detect said failure and transmit a command signal to said second node for instructing the second node to switch from said one working path to said one protection path.

8. A communications network as claimed in claim 7, wherein said first node is a destination node.

9. A communications network as claimed in claim 7, wherein said command signal is transmitted in format in which bit positions represent information.

10. A communications network as claimed in claim 1, 2, 3, 4 or 5, wherein each of said first and second nodes comprises:

a first demultiplexer for receiving a multiplex signal from said one working path for producing drop-off signals;

a first multiplexer for multiplexing add-up signals onto said one working path;

a first path switch connected between said first demultiplexer and said first multiplexer;

a second demultiplexer for receiving a multiplex signal from said one protection path for producing drop-off signals;

a second multiplexer for multiplexing add-up signals onto said one protection path;

a second path switch connected between said second demultiplexer and said second multiplexer;

a transmit protection switch;

a receive protection switch; and

control circuitry for monitoring said one working path and controlling said transmit protection switch so that one of said add-up signals is coupled to said first multiplexer when no failure is detected in said one working path and coupled to said second multiplexer when a failure is detected in said one working path, and controlling said receive protection switch so that one of said drop-off signals of said first multiplexer is received when no failure is detected in said one working path and one of said drop-off signals of said second multiplexer is received when said failure is detected.

11. A communications network as claimed in claim 10, wherein said control circuitry is arranged to exchange control signals with adjacent nodes for controlling said transmit and receive protection switches.

12. A communications network as claimed in claim 10, wherein each of said first and second demultiplexers comprises an optical demultiplexer and each of said first and second multiplexers comprises an optical multiplexer.

13. A communications network as claimed in claim 10, wherein said transmit protection switch includes first and second output ports associated with ones of said working paths and third and fourth output ports associated with ones of said protection paths,

said transmit protection switch being responsive to a control signal from said control circuitry for coupling two add-up signals to said first and second output ports respectively and coupling each one of said two add-up signals to one of the third and fourth ports,

wherein said receive protection switch includes first and second input ports associated with ones of said working paths and third and fourth input ports associated with ones of said protection paths,

said receive protection switch being responsive to a control signal from said control circuitry for receiving two drop-off signals from said first and second input ports and receiving each one of the drop-off signals from one of the third and fourth input ports.

14. A communications network as claimed in claim 11, wherein said transmit protection switch comprises:

first, second, third and fourth optical couplers respectively connected to said first, second, third and fourth output ports; and

first, second, third and fourth optical switches, said first optical switch having outputs respectively coupled to said first, third and fourth optical couplers, said second optical switch having outputs respectively

coupled to said second, third and fourth optical couplers, said third optical switch having outputs coupled respectively to said first and third optical couplers, and said fourth optical switching having outputs respectively coupled to said second and fourth optical couplers.

15. A communications network as claimed in claim 11, wherein said receive protection switch comprises:

first, second, third and fourth optical couplers respectively connected to said first, second, third and fourth input ports; and

first, second, third and fourth optical switches, said first optical switch having inputs respectively coupled to said first, third and fourth optical couplers, said second optical switch having inputs respectively coupled to said second, third and fourth optical couplers, said third optical switch having inputs coupled respectively to said first and third optical couplers, and said fourth optical switching having inputs respectively coupled to said second and fourth optical couplers.

16. A communications network as claimed in claim 14, wherein said transmit protection switch further comprises:

a fifth optical coupler having outputs respectively connected to said first and third optical switches; and

a sixth optical coupler having outputs respectively connected to said second and fourth optical switches.

17. A communications network as claimed in claim 15, wherein said receive protection switch further comprises:

a fifth optical coupler having inputs respectively connected to said first and third optical switches; and

a sixth optical coupler having inputs respectively connected to said second and fourth optical switches.

18. A network node for a ring topology network, the network

having first and second working rings and first and second optical protection rings in a ring topology, and a plurality of working paths on each of said working rings and a plurality of protection paths on each of said protection rings corresponding to said plurality of working paths, the network node comprising:

a first demultiplexer for receiving a multiplex signal from one of the working paths for producing drop-off signals;

a first multiplexer for multiplexing add-up signals onto said one working path;

a first path switch connected between said first demultiplexer and said first multiplexer;

a second demultiplexer for receiving a multiplex signal from one of said protection paths for producing drop-off signals;

a second multiplexer for multiplexing add-up signals onto said one protection path;

a second path switch connected between said second demultiplexer and said second multiplexer;

a transmit protection switch;

a receive protection switch; and

control circuitry for monitoring said one working path and controlling said transmit protection switch so that one of said add-up signals is coupled to said first multiplexer when no failure is detected in said one working path and coupled to said second multiplexer when a failure is detected in said one working path, and controlling said receive protection switch so that one of said drop-off signals of said first multiplexer is received when no failure is detected in said one working path and one of said drop-off signals of said second multiplexer is received when said failure is detected.

19. A network node as claimed in claim 18, wherein said control circuitry is arranged to exchange control signals with adjacent nodes for controlling said transmit and receive protection switches.

20. A network node as claimed in claim 18, wherein each of said first and second demultiplexers comprises an optical demultiplexer and each of said first and second multiplexers comprises an optical multiplexer.

21. A network node as claimed in claim 18, wherein said transmit protection switch includes first and second output ports associated with ones of said working paths and third and fourth output ports associated with ones of said protection paths,

said transmit protection switch being responsive to a control signal from said control circuitry for coupling two add-up signals to said first and second output ports respectively and coupling each one of said two add-up signals to one of the third and fourth ports,

wherein said receive protection switch includes first and second input ports associated with ones of said working paths and third and fourth input ports associated with ones of said protection paths,

said receive protection switch being responsive to a control signal from said control circuitry for receiving two drop-off signals from said first and second input ports and receiving each one of the drop-off signals from one of the third and fourth input ports.

22. A network node as claimed in claim 21, wherein said transmit protection switch comprises:

first, second, third and fourth optical couplers respectively connected to said first, second, third and fourth output ports; and

first, second, third and fourth optical switches, said first optical switch having outputs respectively coupled to said first, third and fourth optical couplers, said second optical switch having outputs respectively coupled to said second, third and fourth optical couplers, said third optical switch having outputs coupled respectively to said first and third optical couplers, and said fourth optical switching having outputs respectively coupled to said second and fourth optical couplers.

23. A network node as claimed in claim 21, wherein said receive protection switch comprises:

first, second, third and fourth optical couplers respectively connected to said first, second, third and fourth input ports; and

first, second, third and fourth optical switches, said first optical switch having inputs respectively coupled to said first, third and fourth optical couplers, said second optical switch having inputs respectively coupled to said second, third and fourth optical couplers, said third optical switch having inputs coupled respectively to said first and third optical couplers, and said fourth optical switching having inputs respectively coupled to said second and fourth optical couplers.

24. A network node as claimed in claim 22, wherein said transmit protection switch further comprises:

a fifth optical coupler having outputs respectively connected to said first and third optical switches; and

a sixth optical coupler having outputs respectively connected to said second and fourth optical switches.

25. A network node as claimed in claim 23, wherein said receive protection switch further comprises:

a fifth optical coupler having inputs respectively connected to said first and third optical switches; and

a sixth optical coupler having inputs respectively connected to said second and fourth optical switches.

26. A fault recovery method for a communications network, wherein the network comprisesa plurality of transmission links, and a plurality of nodes for interconnecting said links to form a working ring and a protection ring in a ring topology, and establishing a plurality of working paths on said working ring and a plurality of protection paths on said protection ring corresponding to said plurality of working paths, the

method comprising the steps of:

a) establishing one of said working paths between source and destination nodes of said plurality of nodes for transmission of a signal in a first direction of said ring topology and establishing one of said protection paths between said source and destination nodes for transmission of a signal in a second direction of said ring topology opposite to said first direction;

b) using said one working path for communication between said source and destination nodes;

c) monitoring said working path at said destination node;

d) transmitting a switching command message from said destination node to said source node if a failure is detected in said working path; and

e) using said one protection path for communication between said source and destination nodes, instead of the failed working path, in response to said switching command message.

27. A fault recovery method for a communications network, wherein the network comprises a plurality of transmission links, and a plurality of nodes for interconnecting said links to form a working ring and a protection ring in a ring topology, and establishing a plurality of working paths on said working ring and a plurality of extra traffic paths on said protection ring, the method comprising the steps of:

a) establishing one of said working paths between source and destination nodes of said plurality of nodes for transmission of a signal in a first direction of said ring topology and establishing one of said extra traffic paths between said source and destination nodes for transmission of a low-priority signal in a second direction of said ring topology opposite to said first direction,

b) normally using said one working path between said source and destination nodes;

c) monitoring said one working path at said destination node;

d) clearing said one extra traffic path to establish a short-haul protection path between said source and destination nodes when a failure is detected in said one working path and using the short-haul protection path, instead of the failed working path, between said source and destination nodes; and

e) clearing other extra traffic paths to establish a long-haul protection path if said short-haul protection path is not successfully established and using said long-haul protection path, instead of the failed working path, between said source and destination nodes.